The Motion of a Free Rotating Body

I SHALL feel obliged if, through the medium of your widely-circulated journal, you will allow me to point out an extraordinary mistake into which Mr. Radau has fallen, in a memoir inserted in the *Annales Scientifiques de l'Ecole Normale Supéreure* tom. vi. 1869, in which he criticises certain of my conclusions about the representation of the motion of a free rotating body contained in a paper published by me in the "Philosophical Transactions" for 1866. In his preamble, M. Radau says, speaking of the theory of rotation in connection with the names of Poinsot, Rueb, Jacobi, and Richelot:—"Tout récemment M. Sylvester a essayé d'appliquer au même sujet des considérations nouvelles qui l'ont conduite à des résultats intéressants, à côté d'autres dont l'exactitude peut être contesteé."

Later on in his memoir M. Radau points out, and accompanies with very biting (albeit toothless) criticism, the nature of his objection, which is, in short, that I suppose Poinsot's ellipsoid, under the influence of an original impulse, to roll without slipping by virtue of its friction against the plane with which it is in contact. My answer is, that of course I do. And why not? when I suppose the plane "indefinitely rough" (see p. 761 of "Philosophical Transactions," 1866), and have actually determined the friction and pressure at each point of the motion, so that by solving a maximum and minimum problem of one variable, the extreme value of the ratio of one of these forces to the other, or if we please to say so, the limiting angle of friction, or, in other words, the necessary degree of roughness of the plane may be analytically determined for every given case. M. Radau falls into the schoolboy blunder of making the *ratio between the friction and pressure constant throughout the motion*, confounding the actual friction with its limiting maximum value! It is, indeed, surprising that such a perversion of the facts of the case should have found insertion in a serious journal, such as that published by the Ecole Normale Supérieure, and I might fairly have expected from M. Radau the courtesy habitual with his adopted countrymen, of applying to me for information on anything in my paper which might have appeared to him obscure or erroneous, before rushing into print with such a *mare's nest*.

But out of evil cometh good. M. Radau says:—"Mais M. Sylvester va plus loin; il pense que le problème pourrait se résoudre par l'observation directe du mouvement d'un ellipsoide matériel tournant sur un plan fixe en même temps qu'il tournerait autour de son centre également fixe. On ne se figure pas facilement par quel artifice on fixerait le centre d'un ellipsoide matériel."

In a future number of your esteemed journal (as time at present fails me) I propose to show how, by the simplest contrivance in the world, a downright material top of ellipsoidal form may be actually made to roll, with its centre fixed, on a fixed plane and so exhibit to the eye the surprising spectacle of a motion precisely identical *in time*, as well as in its successive displacements of *position*, with that of a body, turning round a fixed centre, but otherwise absolutely unconstrained.

This mode of representation, which flashed upon my mind almost instantaneously when my eye first lighted upon M. Radau's objections, is the compensating good to the evil of being made the victim (to the temporary disturbance of my beloved tranquillity) of so hasty and futile a criticism as has been allowed insertion in the "Scientific Annals" of so great an institution as the Ecole Normale of Paris.

The *bureau de rédaction* must surely have been nodding when they allowed such observations, so easily refuted by turning to the original memoir, to pass unchallenged. It was only within the last few days that I received M. Radau's paper.

Athenæum Club, March 8 J. J. SYLVESTER

"Engrais Complet"

IN England many people have no faith in simple remedies with simple names, such, for instance, as brimstone and treacle; but make the same materials into a jam, disguise its flavour, and call it, say, the "Universal Purgative Extract," and then believers in its efficacy will soon be reckoned by the thousand. It seems from a review in a recent number of NATURE, that farmers in France are similarly incredulous on the subject of manures with intelligible names, that they require what is really useful to be mixed with something useless, and called "Engrais Complet," before they will apply it to their land. The English idiosyncracy benefits a large number of patent medicine vendors, and I presume this French variety of it benefits the manure merchants. Let us hope, however, that English farmers will continue to mix their own "Engrais Complet," obtaining, as heretofore, their nitrogen from farmyard manure, guano, and nitrogenous salts; their phosphorus from guano and superphosphate; their potash from organic excreta and potash salts. Under ordinary circumstances, with the Norfolk four-course system, the "Engrais Complet" for barley is left on the land by sheep feeding off roots and oil-cake; that for roots is farmyard manure and super-phosphate; that for wheat is clover roots, with a top-dressing of guano and salt. Clover requires little from the land but potash and good cultivation; but every crop should be fed well enough to leave something handsome for its successor.

Pray excuse my homely comparisons, for although a reader and I hope a student of NATURE, I am still

ONLY A CLOD

The Preservation of Mollusca

THE notice in a recent number of the use of creosote by M. Holbein for the preservation of mollusca, &c., leads me to remark that I have found it of great value for the preservation of coleoptera and other insects. The solution of creosote and water appears to be quite as effectual a preservative as alcohol, and does not harden the tissues or cause discoloration. After an immersion of about a week the solution should be drained off, and the insects placed in tins and covered with sawdust. Probably small reptiles, &c., could equally well be preserved in this way, which would save the danger of leakage and breakage which now ruins so many consignments.

Cambridge. J. R. CROTCH

Frankland and Duppa on the Action of Sodium on Acetic Ether

IN their recent communication to the Royal Society, reported in the last number of NATURE, Messrs. Frankland and Duppa ascribe my not getting hydrogen by the action of sodium on the acetic ethers to the high pressure existing in my sealed tubes.

How could there be a high pressure in my tubes unless I had first developed a large quantity of hydrogen? How then could it possibly be high pressure which prevented my getting any hydrogen? The pressure could not be due to the tension of the vapours of the acetic ethers, for in one experiment I employed acetate of amyl, which boils at 140° C., whilst I heated only to 100° C., and in this case, instead of getting 250 c.c. of gas, I got not a trace of gas. Moreover, the experiment with potassium was made in an open vessel.

On the other hand nothing is plainer than that Frankland and Duppa were operating upon alcohol as well as upon acetic ether, and hence their hydrogen.

London, March 3 J. ALFRED WANKLYN

Sir W. Thomson and Geological Time

I AM curious to know in which of his writings Sir W. Thomson makes the assertion "that there was a time when the earth rotated too swiftly for the existence of life." I cannot see how the assertion, even if it were true, could be of the least use in determining questions as to the length of time during which the earth has been habitable. Certainly it has not the slightest connection with Thomson's argument as to the date of consolidation of the earth, founded on its figure and on the retardation of its rotation by tidal friction. Yet the assertion is distinctly ascribed to Thomson—*first* in the *Pall Mall Gazette*, May 3, 1869, and *secondly* in the *Edinburgh Review* for January last.

If the passage quoted, or at least something resembling it, cannot be found in Thomson's writings, I am anxious to know whether the charge is due to simple stupidity on the part of the critics (or critic?), or whether it proves more?

G. H.

Little Gull (*Larus minutus*)

IN the proceedings of the Royal Physical Society of Edinburgh, as reported in NATURE, July 17, Dr. Smith notices the capture of a specimen of the Little Gull (*Larus minutus*) in Scotland, and remarks that it is a rare straggler to Scotland, only some two or three specimens having been previously recorded. Although rare in Scotland, it is by no means uncommon on the Yorkshire coast during the autumn and winter, and specimens are frequently shot during these seasons near Flamborough Head and along the Bridlington coast. This winter they have been more than usually plentiful. Mr. Richardson, of Beverley,

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in a letter dated February 18, informs me "I have received thirteen Little Gulls, shot on the Bridlington coast during the last fortnight, seven adults and six immature." And, in a recent communication, "There have been twenty-nine Little Gulls shot in all, nineteen old and ten young birds."

I have a photograph of an adult bird in breeding plumage, with the black head, shot at Flamborough on July 13, 1868.

Great Cotes, Ulceby, Feb. 25 JOHN CORDEAUX

THE MICROSCOPIC FAUNA OF THE ENGLISH FEN DISTRICT

THE results of some recent researches amongst the Entomostraca of the rivers and "broads" of Norfolk and the adjacent counties have proved so interesting that a brief *résumé* of the subject will probably not be unacceptable to the readers of NATURE.

My attention was first directed to the district in the following manner:—My friend, Mr. E. C. Davison, a gentleman attached to the staff of H.M.S. *Porcupine*, has for several years interested himself very kindly, during the annual cruises of the vessel, in collecting for me such Entomostraca and other Microzoa as came in his way. Amongst the gatherings which thus came into my hands were two samples of sand from the Dutch rivers Maas and Scheldt, some similar dredgings from the English river Ouse (Norfolk), and one from Oulton Broad in Suffolk. The Dutch gatherings had been in my hands for several years, and their ostracoda described in the "Annals and Magazine of Natural History," before I received those from the English localities. An examination of these at once revealed a remarkable similarity between the inhabitants of all the localities—several species, up to that time unknown in Britain, being recognised as identical with some of those taken in Holland. This interesting observation induced me, in company with Mr. D. Robertson, of Glasgow, to visit the Fen district with a view of more thoroughly investigating its microscopic fauna—an inquiry which has resulted in very much strengthening our original view as to its close relationship with that of Holland, and seeming, moreover, to indicate that we have in the English fens a very remarkable group of Ostracoda and Foraminifera marked out by a hard and fast line, and forming a district fauna quite unparalleled in its isolation, as regards the surrounding British species.

The fact of a partial relationship between the fauna of the Fen counties, or East Anglian district, as we may conveniently call it, and that of North-Western Europe is not new; and the best account of the matter that I know of may be found in an interesting article on "The Fens," by the Rev. Canon Kingsley, in *Good Words* for 1867. The facts which most prominently indicate this relationship are the presence of various fishes of the family Cyprinidæ—roach, dace, &c., which attain their highest development in the rivers and lakes of Sweden,—of the "bearded tit," now however probably nearly extinct, and of the remains of the fresh-water tortoise, *Emys lutaria*, now an inhabitant only of Central and Eastern Europe, and whose presence in England can scarcely be accounted for except on the supposition of a free river communication between our island and the Continent during a bygone geological epoch. That the Straits of Dover were, indeed, not very long ago (geologically speaking) bridged over by dry land, and that at that time the rivers of North-Western Europe emptied themselves into one great estuary situated between us and the Scandinavian peninsula are well-established facts; and it is as giving additional confirmation to this belief by exhibiting perhaps more fully than has previously been done the close relationship of the fluvial faunas of East Anglia and Holland, that our present observations claim their chief interest. For it is evident that two faunas, possessing in common, even according to our present imperfect knowledge, a considerable number of species at once very peculiar in character, apparently very restricted in their distribution, and separated at the present time by a wide expanse of sea, must have sprung originally from one common centre, and can scarcely have been finally separated for any great length of time. The fishes to which we have referred have indeed spread, either through natural or artificial agencies, from the eastern rivers to other parts of England and even to Ireland. But this crustacean fauna seems to be rigidly confined to the Fen district of Norfolk and Suffolk on the western side of the German Ocean, and to the rivers of Holland on the eastern side. We make this assertion with some reserve, because much yet remains to be done in the examination of aquatic microzoa everywhere, and it is just possible that some of those species which we take to be peculiar to the Fen fauna may turn up elsewhere. But we have ourselves examined dredgings from many English rivers, especially on the east coast, and have explored in the search for Entomostraca (though without dredging), the lake districts of England and Southern Scotland, without ever meeting with any of them. In no part of the continent of Europe have the Entomostraca received so much attention as in Scandinavia, where, if anywhere, we should expect a similar fauna to be found. But neither Müller, Lilljeborg, nor Sars appears to have met with such. Nor does M. Felix Plateau's recent memoir on the "Fresh-water Crustacea of Belgium" mention any similar species, though we cannot help thinking that had the dredge been used there, the result would have been different.

Out of about 180 known species of British Ostracoda, eighty may be frequently met with in river estuaries or in marine situations where much fresh water habitually mingles with the salt. Of these, thirteen may be considered as coming down to the debatable ground from the fresh-water side and fifty-six from the sea; the remaining eleven haunt brackish water almost exclusively, so much so, indeed, that were they found to any large extent in a fossiliferous deposit, we should have no hesitation in saying that it was produced under brackish conditions.

Of about 100 species and varieties found in the Fen district and its outlets, sixty-eight may be looked upon as usual inhabitants of either marine or estuarine situations. These are met with chiefly in the river outlets, and being, doubtless, derived from the sea may be left out of sight in any consideration of the fauna of the Fens. Again, nineteen are widely-distributed fresh-water species, of which little need be said except that those of the genus *Candona*, especially *C. compressa*, *albicans*, and *lactea*, seem here to attain a finer development and to exist in much greater abundance than in any other district. In connection with this it is curious to observe that the genus occupies an intermediate position between the crawling, non-natatory marine Cytheridæ and the freely swimming fresh-water Cyprides. Twelve (?) species, mostly undescribed, seem to be entirely or almost entirely confined to the fens of England and the corresponding districts of Holland, for we regard their appearance in dredgings from the estuaries of the Scheldt and Meuse as evidence, not of their *living* in those situations, but of their probable abundant existence nearer the water-head. Dead shells of the same species are met with in a similar manner in the river outlets of Norfolk, such as the Ouse and Breydon water, their real habitat being the fresh-water "broads" and the dykes and rivers as high up as, and very probably higher than, Peterborough and Ely.

The peculiar species of the district are the following:—*Goniocypris mitra*, Brady and Robertson; *Metacypris cordata*, B. and R.; *Cypris fretensis*, B. and R.; *Cypridopsis Newtoni*, B. and R.; *Candona Kingsleii*, B. and R.; *C. hyalina*, B. and R.; *Cythere fuscata*, Brady; *Limnicythere monstrifica*, Norman; *L. Sancti Patricii*, B. and R.; *Polycheles Stevensoni*, B. and R.; with some few other species of which

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